

REMARKS

Claims 1 - 19 remain active in this application. The specification has been reviewed and editorial revisions made where seen to be appropriate. Claims 1, 7 - 10 and 12 have been amended (including reformatting of claim 12) to improve form and clarity. Support for the amendments of the claims is found throughout the application, particularly in Figures 4 and 5 and the description thereof on pages 18 - 26. No new matter has been introduced into the application. The withdrawal of the previous requirement for restriction is noted with appreciation.

Claims 1 - 11 have been rejected under 35 U.S.C. §112 as being indefinite; the Examiner criticizing claims 1 and 8 - 10 and noting that claim 7 is a duplicate of claim 2; the remaining claims involved evidently being included by dependency. This ground of rejection is respectfully traversed as being moot in view of the amendments made above.

By the above amendment, claim 1 has been substantially rewritten and antecedent language for "said mirror" has been provided. Similarly, claims 8 and 9 have been amended such that correspondence with antecedent language is now exact. Claim 10 has been revised in dependency and amended such that antecedent language references are now exact, as well. Claim 7 has been made dependent upon claim 3 and is thus no longer a duplicate of claim 2. A typographical revision has also been made in claim 7. Therefore, it is believed that the Examiner's criticisms have been fully answered and that the claims are now in good form. Accordingly, reconsideration and withdrawal of this ground of rejection are respectfully requested.

Claims 1 - 11 have been rejected under 35 U.S.C. §103 as being unpatentable over Kedar et al. in view of Hippenmeyer and claims 12 - 18 (sic - 19) have been

rejected under 35 U.S.C. §103 as being unpatentable over Kedar et al. in view of Hippenmeyer and Ikurumi et al. The Examiner also takes official notice in regard to the reading of a zip-code and appears to include claim 19 in the latter ground of rejection. These grounds of rejection are respectfully traversed, particularly as being moot in view of the amendments made above.

The invention, in accordance with its most basic principles, is directed to an optical system for digital imaging in which a well-focused image can be formed at *constant magnification and resolution over a broad range of distances of objects from the objective element of the lens system* in order to read, for example, address information on objects of different heights or thicknesses without having to provide for reading such information through a window or the like against which a surface of the object may be placed. Particular benefits of this capability are that the image data need not be processed to normalize size of imaged content such as indicia, allowing increased speed of response and throughput of a controlled system and that image detail can be equally resolved and processed regardless of distance between the object to be imaged and the imaging system, as discussed at page 20 of the present specification.

The system of Kedar et al. is directed to making optical measurements of wells in a microtiter or multi-well plate. While Kedar et al. teaches use of a doubly telecentric lens system to exploit its properties of avoiding angled principal rays (so that the lens can simultaneously "look" into each well axially of each well of even very large multi-well plates as noted at column 7, line 41: "each well is seen identically") and lack of vignetting (illumination fall-off with distance from the lens axis), the remainder of the requirements of the optical system appear to be diametrically

opposed to those of the invention.

Specifically, the plate to be imaged in Kedar et al. is always a fixed distance from the objective element of the doubly telecentric lens (see column 7, line 53) and magnification must be altered so that an integral number of pixels of the image sensor correspond to each well and do not overlap the edges of two or more wells, causing "cross-talk" between wells (see column 3, lines 39 - 41 and column 11, lines 29 - 46). Kedar et al. states, at column 7, lines 48 - 50, that magnification is not adjustable, as is necessary in Kedar et al., by moving the lens and image plane relative to the object and provides an object field lens which remains fixed relative to the object while the remainder of the lens moves during necessary adjustment of magnification.

Resolution and focusing are relatively non-critical in Kedar et al. since the pixel outputs for respective wells are "binned" over each "superpixel" (e.g. 21x21 or 14x14 arrays of adjacent pixels - see column 11 lines 38 - 46) corresponding to each respective well. It is also noted at column 7, lines 18 - 36, that out-of-focus images made by telecentric lenses are of the same magnification as in-focus images which is important in avoiding cross-talk between images of individual wells while precise focusing may not be possible when solution depth in wells may be of sufficient depth that the solution surface and the well bottom are in significantly different focal planes. Note also that Kedar et al. *assumes* that parts of the image are defocused as a result of imaging different depths of solution at column 7, lines 45 - 47. In other words, in Kedar et al., focusing need only be sufficient to prevent the circle of confusion of a defocused image of a point in one well from overlapping the inter-well wall and causing cross-talk in the image of another well while adjustment of magnification is

absolutely critical to establish the superpixels and their correspondence to respective wells of the multi-well plate whereas, in the present invention, magnification must remain sufficiently constant to avoid a need for additional processing of image data to normalize image scale over a substantial range of distances to the object to be imaged while focusing is relatively more critical in order to image fine detail (not present in Kedar et al). Moreover, since the distance between the optical system objective lens and the multi-well plate is constant in Kedar et al., focusing need only be performed to the extent required to compensate for defocusing incident to *required* changes in magnification. Resolution, of course, particularly in regard to pixels or superpixels of fixed area, varies with the necessarily variable magnification of Kedar et al.

Therefore, while Kedar et al. provides an arrangement which decouples magnification and focusing adjustments of the lens system (column 13, lines 7 - 23), Kedar et al. contains no teaching, suggestion or even recognition that well-focused images of constant magnification and resolution can be formed by a doubly telecentric lens over a range of distances of objects from the lens system or objective element. Therefore, Kedar et al. does not and cannot lead to an expectation of success in doing so in order to provide evidence of a level of ordinary skill in the art which would support a conclusion of obviousness of the claimed subject matter (e.g. using an objective lens of a camera having a focusing means as an element of a doubly telecentric lens). Conversely, even if such evidence were otherwise presented by secondary references (which it is not), any proposed modification of Kedar et al. to answer the claim recitations and support such a meritorious function (also recited in independent claims 1 and 18) as now amended would be

improper since it would preclude the necessary and critical magnification adjustment of Kedar et al. and thus preclude the operation of Kedar et al. in the manner intended. See for example, In re Gordon, 221 USPQ 1125 (Fed. Circ., 1984). Hippenmeyer is apparently cited for teaching the use of a mirror as an element in a doubly telecentric lens system but is not asserted to mitigate any of the deficiencies of Kedar et al. discussed above. It should be noted, in particular, that column 3, lines 1 - 8 of Hippenmeyer discuss the circumstance when the distance of the surface to be imaged is changed and indicates that the objective of the diode row camera must be "set to a correspondingly closer distance" than infinity, as discussed at column 2, lines 53 - 68, of Hippenmeyer. Such an action will clearly cause a change in magnification as discussed on page 16 of the present specification in regard to an object telecentric lens arrangement illustrated in Figure 2.

Further, it is unclear from Kedar et al. what camera 44 may comprise. Column 13, refers to moving camera 44 independently of any portion of the lens system (e.g. of Figure 3) to achieve focusing and column 13, line 38 recites that "any suitable camera" may be used. Both of these passages seem to infer that the camera includes a lens system independent thereof, contrary to the recitations of the apparatus claims which recite the objective lens of the camera as part of the doubly telecentric lens system. On the other hand, column 7, line 55 indicates that focusing may be performed by "moving the camera or detection device", in which case, camera 44 may simply be a structure for locating a sensor array and does not include any lens element at all. In either case, Kedar et al. does not teach or suggest using the objective lens of a camera including focusing means as an element of a doubly telecentric lens and does not recognize the meritorious

and useful effect which may be obtained by doing so. It is respectfully submitted that, despite this ambiguity of Kedar et al., the only construction thereof which could even colorably answer the recitations of the claims would be to consider the image telecentric lens arrangement (e.g. 16) of Kedar et al. as the camera objective lens; a construction that can only be reached through hindsight and, since the lenses of this image telecentric group are clearly of high criticality, contrary to the statement in Kedar et al. that "any suitable camera" can be used". Again, Hippenmeyer does not mitigate this deficiency of Kedar et al.

In regard to the rejection of claims 12 - 19 in which the Examiner additionally relies upon the teachings of Ikurumi et al., it is also respectfully submitted that Ikurumi et al. does not mitigate any of the deficiencies of Kedar et al. and, while it may teach a belt conveyor and a determination control unit in an automatic inspection system, it does not teach any utility of the determination control unit in an arrangement such as that of Kedar et al. and, more importantly, does not teach any control of the conveyor such that the critical alignment required in Kedar et al. could be maintained and for which the doubly telecentric lens arrangement is used therein. Again, such a modification is directly contrary to the teachings of Kedar et al. and would render the apparatus of Kedar et al. inoperative for the intended purpose (see *In re Gordon*, *supra*). Therefore there can be no motivation for the combination of teachings Ikurumi et al. and those of Kedar et al. and Hippenmeyer. Further, Ikurumi et al. is concerned with the inspection of similar articles and thus is not concerned with accommodating different distances between the surface to be imaged and the optical system in regard to focus or magnification but only with

coordinating the object motion with a line scan image sensor to obtain orthogonal scanning of the object surface. Therefore, Ikurumi et al. can provide no evidence of the level of ordinary skill in the art in regard to providing well-focused images at substantially constant magnification and resolution over a substantial range of distances which could support a conclusion of obviousness, even if the asserted combination with Kedar et al. and Hippenmeyer were proper. Thus, the Examiner has not demonstrated how the applied prior art addresses such claim recitations as the constitution of the doubly telecentric optical system of claim 12 or the imaging of visible information on articles of irregular sized and which are moved to a doubly telecentric optical system for such imaging as recited in claim 18.

In regard to claim 19, while it is conceded that machine reading of zip-codes is known, *per se*, the Examiner's taking of official notice in regard thereto is based on the illogical assertion that it would be obvious to apply a zip code to a printed circuit board and is thus improper. Further, the assertion of obviousness (of a claim not otherwise rejected as noted above) appears to fail to consider the subject matter of the claim as a whole (and the recitations of claim 18 in particular) and is improper for that reason, as well.

Accordingly, it is respectfully submitted that the Examiner has not made and cannot make a *prima facie* demonstration of obviousness of the subject matter of any claim in the application. The prior art relied on largely teaches away from the claimed subject matter and does not lead to an expectation of success in realizing the meritorious effects of the invention. Moreover, the teachings and suggestions of the respective references applied by the Examiner are not properly combinable and have clearly been largely

construed and applied through impermissible hindsight. Therefore it is respectfully submitted that the asserted grounds of rejection are in error and untenable and reconsideration and withdrawal thereof is respectfully requested.

Since all rejections, objections and requirements contained in the outstanding official action have been fully answered and shown to be in error and/or inapplicable to the present claims, it is respectfully submitted that reconsideration is now in order under the provisions of 37 C.F.R. §1.111(b) and such reconsideration is respectfully requested. Upon reconsideration, it is also respectfully submitted that this application is in condition for allowance and such action is therefore respectfully requested.

If an extension of time is required for this response to be considered as being timely filed, a conditional petition is hereby made for such extension of time. Please charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2041.

Respectfully submitted,



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